

Physico-Chemical nanomaterials science

Influence nanopowder SiO₂ CaO on optical characteristic of ceramic YAG:Cr,Ca

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The subject of ceramics covers a wide range of materials. Ceramics commonly used for electrical, magnetic, electronic, and optical applications. Different impurities used for modification properties and increase characteristic ceramics. The purpose of this work investigate influence nanopowder SiO₂ and CaO on optical characteristic of ceramic YAG:Cr,Ca.

Ceramic YAG:Cr,Ca (Ca = 0.5, 0.8, 1.2 at%) with SiO₂ and without SiO₂ (Ca = 0.04, 0.16, 0.5, 0.8 at%) was sintered. Sintered was performed by solid state reaction at 1750 °C for 10 hours in vacuum furnace. Obtained ceramics were investigated with scanning electron microscopy (JEOL JSM-6390LV) and optical spectroscopy (Specord 200).

Grain size distribution for ceramic YAG:Cr,Ca was calculated. This ceramic consist of grain from 0.5 to 2 µm. Ceramic not contain nanocalcium consist on grain from 2 to 50 µm. One is a possible reason decrease grain grow this presence nanocalcium on grain boundary. This decrease grain boundary diffusion coefiseent and as result grain boundary mobility. Absorption spectra ceramic YAG:Cr,Ca without SiO₂ show the existence of optimal CaO concentration.

Usually in ceramic technology for increasing process of densification sintering aid (SiO₂) are used. Compared absorption spectra of ceramic YAG:Cr,Ca with SiO₂ and without SiO₂ can conclude that presence SiO₂ in ceramic [1] YAG:Cr,Ca decrease process of densification. The possible reason decrease optical properties in ceramic YAG:Cr,Ca is formation of calcium metasilicate CaSiO₃.

Therefore sintering aid SiO₂, which widely used in ceramic technology, is not working in system YAG:Ce,Ca. Presence nanocalcium in ceramic decrease grain size range

1. Kochawattana S., Stevenson A., Lee S., Ramirez M., Gopalan V., Dumb J., Castillo V., Quarles G., Gary L., Sintering and grain growth in SiO₂ doped Nd:YAG // Journal of the European Ceramic Society.-2008.-28.-P. 1527-1534.